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EXAMINER	
WERNER, BRIAN P	
ART UNIT	PAPER NUMBER
2621	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/294,137	MAEDA ET AL.	
	Examiner	Art Unit	
	Brian P. Werner	2621	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 March 2002* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,7-15 and 17-36* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,7-15 and 17-36* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *11 March 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Response to Amendment

1. The amendment received on March 11, 2002 has been entered. Claims 1, 2, 7-15 and 17-36 are now pending.

2. It is noted that the preliminary amendment (paper #4), received on July 13, 1999, had been entered and considered by the examiner at the time of the previous Office Action. This was indicated on the Office Action Summary sheet (i.e., the cover sheet for the Office Action) in box 1, "Responsive to Communications".

Response to Arguments

3. Applicants arguments and remarks, which accompanied the amendment received on March 11, 2002, are each addressed below:

Preliminary Amendment: In response to applicant's remark that entry and consideration of the preliminary amendment was not noted in the previous Office Action (response page 14), it is noted that the preliminary amendment received on July 13, 1999 had been entered and considered by the examiner at the time of the previous Office Action. This was indicated on the Office Action Summary sheet (i.e., the cover sheet for the Office Action) in box 1, "Responsive to Communications". In addition, the examiner has formally noted this in the response to amendment section above per applicant's request.

Drawing Objections: Applicant requests withdrawal of the drawing objections in light of the new drawings (response pages 14-15). Examiner agrees. The new drawings filed on March 11, 2002 are acceptable. All previous objection have been overcome.

112 Rejections: Applicant requests withdrawal of the previous 35 U.S.C. 112 rejections in light of the amendment (response page 15). Examiner agrees. The elements of these claims are now supported by a proper antecedent basis.

New Claims: Applicant remarks throughout the response that the prior art of record does not teach the elements of new claims 31-36. In response, a new grounds of rejection necessitated by these claims is advanced herein.

The Art Rejections: Applicant's arguments are rendered partially moot in view of the new grounds of rejection advanced herein and below. However, each ground of rejection shall be addressed inasmuch as applicant's remarks remain applicable.

The Wihl Reference: Regarding the Wihl reference as it was, and is applied to independent claims 15, 18 and 20, applicant argues that "Wihl does not disclose or suggest at least the features of claims 15 and 34 which are underlined above (response page 17). New claim 34 is addressed by the examiner in a new grounds of rejection below. The underlined features pertaining to claims 15, 18 and 20 include alignment with an "accuracy of one pixel unit", a "gradation conversion to correct brightness", and a comparing of the "aligned first and second images, at least one of which has a brightness which has been corrected" (response page 16). Regarding the alignment with an accuracy of one pixel unit, the Danielson reference has been added to teach

this previously unclaimed feature. Claims 15, 18 and 20 are now rejected over the combination of Wihl and Danielson; the rejection being necessitated by the amendment. Regarding the gradation conversion to correct brightness, Wihl teaches this feature as explained in the rejection below. This feature of the Wihl system was pointed out by the examiner in the previous Office Action (i.e., see Wihl, figure 2, numerals 54 and 56; "7 X 7 Finite Impulse Response filter" that "produces a corrected pixel of the output as the weighted sum of each pixel of input and its nearest 48 neighbors" at column 2, line 50). While applicant alleges that Wihl does not teach a gradation conversion, no evidence is provided as to how Wihl's pixel vale "correction" does not meet the claimed criteria. Examiner maintains that the correction of pixel values as disclosed by Wihl (i.e., "produces a corrected pixel ... of each pixel" at column 2, line 51) meets the criteria of a gradation conversion as pixel gradations are converted locally (i.e., within a 7 X 7 window) for both images to correct the brightness, or intensity gradations in the images. Regarding the comparison of aligned and corrected images, Wihl compares the images after alignment and after gradation conversion as depicted in figure 2, numeral 64, and as explained in the previous Office Action at paragraph 8. The alignment and gradation conversion places the images in a condition suitable for the comparison.

The Lee Reference: Regarding the Lee reference as it was and is applied to claims 1, 4, 8-14 and 22-26, applicant argues "Lee does not disclose or suggest at least the features of claims 1, 8, 22, 31, 33, and 35 which are underlined above". New claims 31, 33 and 35 are addressed by the examiner in a new grounds of rejection below. The underlined features pertaining to these claims include alignment with an "accuracy of

one pixel unit", a "gradation conversion to locally match a brightness", and a comparing of the "aligned first and second images, at least one of which has a brightness which has been corrected" (response page 16). Regarding the alignment with an accuracy of one pixel unit, the Danielson reference has been added to teach this feature. The claims are now rejected over the combination of Lee and Danielson; the rejection being necessitated by the amendment. Regarding the gradation conversion to locally match a brightness, Lee teaches this feature as explained in the rejection below, and as explained in paragraph 9 of the previous Office Action. That is, Lee teaches that the intensity values of each pixel are corrected in order that the images correspond in brightness to one-another (i.e., "test and reference images differ slightly in intensity" and the "system 20 compensates for these normal intensity differences (step 220) by providing an intensity offset" at column 6, line 15; "offsetting the intensity values of each reference pixel" at column 6, line 32). While applicant alleges that Lee does not teach a gradation conversion to match brightness, no evidence is provided as to how Lee's pixel vale conversion, or offsetting of pixel values so that the images correspond with one another does not meet the claimed criteria. Examiner maintains that the conversion of pixel values, as disclosed by Lee, meets the criteria of a gradation conversion. Regarding the comparison of aligned and corrected images, Lee compares the images after gradation conversion and alignment respectively (figures 2A – 2B, numeral 210 is the alignment, numeral 220 is the gradation conversion, and numeral 235 is the comparison).

The Lebeau and Kobayashi Combination: Regarding the Lebeau and Kobayashi combination alone, and as further modified by the teachings of Wagner and Haskell, applicant states that "Lebeau, Kobayashi, Wagner, and Haskell do not disclose or suggest at least the features of claims 1, 15, 27, 31, 34, and 36 which are underlined above. New claims 31, 34 and 36 are addressed by the examiner in a new grounds of rejection below. The underlined features pertaining to these claims include alignment with an "accuracy of one pixel unit", a "gradation conversion to locally match a brightness", and a comparing of the "aligned first and second images, at least one of which has a brightness which has been corrected" (response pages 20-22). Regarding the alignment with an accuracy of one pixel unit, the Danielson reference has been added to the Lebeau and Kobayashi combination to teach this previously unclaimed feature. The claims are now rejected over the combination of Lebeau, Kobayashi, and Danielson; the rejection being necessitated by the amendment. Regarding the gradation conversion to locally match a brightness, Lebeau teaches this feature as explained in the rejection below, and as explained in paragraph 11 of the previous Office Action. That is, Lebeau teaches that the intensity values of each pixel are corrected in order that the images correspond in brightness to one-another (i.e., the graylevels of the "[r]un image ... are then mapped based on a comparison of the mean brightness of the taught image to that of the run image" so "the mean brightness level ... is the same as the mean value of taught image" at column 5, lines 50-54). While applicant alleges that Lebeau does not teach a gradation conversion to match brightness, no evidence is provided as to how Lebeau's pixel vale mapping (so that the

images correspond with one another) does not meet the claimed criteria. Examiner maintains that the conversion of pixel values, as disclosed by Lebeau, meets the criteria of a gradation conversion to match brightness. Regarding the comparison of aligned and corrected images, Lebeau converts the gradation after the images have been aligned (the images are aligned before the gradation processing at column 5, line 54), followed by the comparison of the aligned and gradation converted images ("subtracting" at column 6, line 57).

The Dependent Claims: Regarding the various dependent claims, applicant argues generally and throughout the response that because the independent claims distinguish over the prior art, that the dependent claims are allowable. No other specific arguments regarding the dependent claims are advanced. However, the independent claim remain rejected over the prior art as explained below. Given that the dependent claims have been amended to correct for grammatical errors and form, and that the limitations therein remain equivalent to that which was previously claimed, these claims are still met by the prior art as explained in the previous Office Action. The details of these rejections are not repeated herein below for the sake of brevity.

Drawings

4. The formal drawings were received on March 11, 2002. These drawings are acceptable to both the examiner and the draftsman. Applicant's previous drawing correction has been incorporated into these drawings, and all of the examiner's objections have been overcome. Further changes will not be required.

Claim Rejections - 35 USC § 103

5. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

6. Claims 15, 18 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Wihl (US 4,633,504 A – art of record) and Danielson et al. (US 4,926,489 A – new art).

The content of the Wihl reference was addressed in paragraph 8 of the previous Office Action; the details of which are incorporated herein by reference. Regarding claim 15 as amended, Wihl discloses local gradation conversion means for performing local gradation conversion to correct a brightness (figure 2, numerals 54 and 56; "7 X 7 Finite Impulse Response filter" that "produces a corrected pixel of the output as the weighted sum of each pixel of input and its nearest 48 neighbors" at column 2, line 50).

While Wihl discloses an alignment means for aligning the first and second images (figure 2, numeral 66), Wihl does not disclose the accuracy of the alignment.

Specifically, Wihl does not teach the alignment of the two images with an accuracy of one pixel unit as now claimed.

Danielson discloses a system in the same field of pattern inspection, and particularly photomask inspection (figure 1; the mask is depicted as numeral 24), and same problem solving area of image alignment (figure 1, numeral 66), comprising an alignment means for aligning first and second images (figure 1, numeral 66) with an accuracy of one pixel unit ("alignment system includes ... detection of alignment errors in excess of +/- 1 pixel" at column 6, line 11).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to align the two images as required by Wihl, with an accuracy of one pixel unit using the alignment means taught by Danielson, in order to "compensate for registration errors present when comparison of a reticle or photomask is made ... where spatial resolution of the automatic system is very high and the inspection speed rapid" (Danielson, column 6, line 2), such that "alignment can be properly maintained in the presence of large areas devoid of patterns" (Danielson, column 6, line 19), and ultimately to provide a "high speed, continuous process" where "no stopping or restriction of the pixel stream is necessary, and continuous correction of alignment can be performed" (Danielson, column 14, line 60).

7. Claims 1, 4, 8-14 and 22-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Lee et al. (US 5,808,735 A – art of record) and Danielson et al. (US 4,926,489 A – new art).

The content of the Lee reference was addressed in paragraph 9 of the previous Office Action; the details of which are incorporated herein by reference. Regarding independent claims 1, 8 and 22 as amended, Lee discloses local gradation conversion means for performing local gradation conversion to correct a brightness, and thereby match the brightness of one image to that of the other (i.e., "test and reference images differ slightly in intensity" and the "system 20 compensates for these normal intensity differences (step 220) by providing an intensity offset" at column 6, line 15; figure 2A, numeral 220; "normalized for intensity" at column 6, line 42; as described at column 6, lines 30-33, the intensity values of the images are made to correspond more closely with one-another, or corrected with respect to one-another, based on a histogram of differences).

Regarding claims 8, 11, 24 and 26 specifically, Lee teaches image comparison after first aligning the images, and then gradation correcting the images (figures 2A – 2B, numeral 210 is the alignment, numeral 220 is the gradation conversion, and numeral 235 is the comparison).

Regarding the remainder of the dependent claims, the limitations therein are met by Lee as described in paragraph 9 of the previous Office Action. While these claims have been amended to correct for grammatical errors and form, the limitations therein remain equivalent to that which was previously claimed and are thus still met by Lee.

Regarding each of the claims, while Lee discloses an alignment means for aligning the first and second images (figure 2A, numeral 210), Lee does not disclose the alignment accuracy; other than it is "conventional alignment" at column 4, line 54.

Specifically, Lee does not teach the alignment of the two images with an accuracy of one pixel unit as now claimed.

Danielson discloses a system in the same field of substrate pattern inspection (figure 1; the mask is depicted as numeral 24) and same problem solving area of image alignment (figure 1, numeral 66), comprising an alignment means for aligning first and second images (figure 1, numeral 66) with an accuracy of one pixel unit ("alignment system includes ... detection of alignment errors in excess of +/- 1 pixel" at column 6, line 11).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to align the two images as required by Lee, with an accuracy of one pixel unit using the alignment means taught by Danielson, in order to "compensate for registration errors present when comparison of a [substrate] is made ... where spatial resolution of the automatic system is very high and the inspection speed rapid" (Danielson, column 6, line 2), such that "alignment can be properly maintained in the presence of large areas devoid of patterns" (Danielson, column 6, line 19), and ultimately to provide a "high speed, continuous process" where "no stopping or restriction of the pixel stream is necessary, and continuous correction of alignment can be performed" (Danielson, column 14, line 60).

8. Claim 1, 5, 7, 15, 21 and 27-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Lebeau (US 5,204,910 – art of record), Kobayashi et al. (US 4,669,123 – art of record) and Danielson et al. (US 4,926,489 A – new art).

The content of the Lebeau reference was addressed in paragraph 11 of the previous Office Action; the details of which are incorporated herein by reference. Regarding independent claims 1, 7, 8, 15 and 27 as amended, Lebeau discloses local gradation conversion means for performing local gradation conversion to match a brightness of one image to that of the other (i.e., the graylevels of the "[r]un image ... are then mapped based on a comparison of the mean brightness of the taught image to that of the run image" so "the mean brightness level ... is the same as the mean value of taught image" at column 5, lines 50-54).

Regarding claims 21 and 28 specifically, Lebeau converts the gradation after the images have been aligned (the images are aligned before any of the gradation processing at column 5, line 54), and then compares the aligned and gradation converted images ("subtracting" at column 6, line 57).

Regarding the remainder of the dependent claims, the limitations therein are met by Lebeau as described in paragraph 11 of the previous Office Action. While these claims have been amended to correct for grammatical errors and form, the limitations therein remain equivalent to that which was previously claimed and are thus still met by Lebeau.

Regarding each of the above claims, while Lebeau discloses the alignment ("registered" and "rotation and spatial position" at column 3, line 60) and comparison of images of patterns in two images ("compared by algebraically subtracting the respective graylevel values at each pixel location" at column 6, line 56; "bright defects" and "dark defects" are detected at column 7, line 24), Lebeau does not teach (1) the image of the

second pattern being formed on the same substrate as the first, and (2) the aligning having an accuracy of one pixel unit.

Regarding the first difference (i.e., the claim limitation that requires the image of the second pattern to be formed on the same substrate as the first), Kobayashi discloses a system in the same field of semiconductor defect inspection ("inspecting method and apparatus" and "semiconductor device" at column 1, line 7), wherein Kobayashi teaches comparing images of first and second patterns picked-up from the same substrate ("pattern comparing method one unit pattern is compared with another unit pattern having the same shape and size" at column 1, line 23). Kobayashi describes how the traditional "database comparing method requires a lot of inspecting time and covers a lot of design data" (column 1, line 27) and that "the pattern comparing method is preferable to the database comparing method for inspection of complex photomask patterns" (column 1, line 29).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Lebeau system by picking up both the taught and run images from the same substrate as taught by Kobayashi, thus realizing the benefits of the pattern comparing method taught by Kobayashi including the reduction of inspection time when inspecting the complex patterns of a semiconductor device, and eliminating the need to process and store a reference for comparison (as the normally identical semiconductor devices on a wafer are compared with each other).

Regarding the second difference (i.e., the claim limitation that requires alignment to a single pixel unit), Danielson discloses a system in the same field of substrate

pattern inspection (figure 1; the mask is depicted as numeral 24) and same problem solving area of image alignment (figure 1, numeral 66), comprising an alignment means for aligning first and second images (figure 1, numeral 66) with an accuracy of one pixel unit ("alignment system includes ... detection of alignment errors in excess of +/- 1 pixel" at column 6, line 11).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to align the two images as required by the above Lebeau and Kobayashi combination, with an accuracy of one pixel unit using the alignment means taught by Danielson, in order to "compensate for registration errors present when comparison of a [substrate] is made ... where spatial resolution of the automatic system is very high and the inspection speed rapid" (Danielson, column 6, line 2), such that "alignment can be properly maintained in the presence of large areas devoid of patterns" (Danielson, column 6, line 19), and ultimately to provide a "high speed, continuous process" where "no stopping or restriction of the pixel stream is necessary, and continuous correction of alignment can be performed" (Danielson, column 14, line 60).

Regarding dependent claims 7 and 27 specifically, while Lebeau teaches "recording locations of bright defects 56 and dark defects 54 for later analysis" at column 7, line 24, Lebeau does not specifically teach displaying the detected defects and the information of features of the detected defects on a screen.

Kobayashi also teaches displaying the detected defects and information of features of the detected defects on a screen ("human inspector can check the inspection results by observing the stored data in the stage coordinate memory 300 on

the inspection output device 400 such as a cathode-ray tube" at column 4, line 12; the features include "the stage position at which there is a defect" at line 5; thus, given that each defect detected is output to the operator on a CRT, the defects are displayed; that the claim does not require any particular form of visual display, only that the defects are displayed; also, given that the coordinates of where the defect exists are displayed, information about the defects is displayed).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to display the detected defects and information of detected defect features on a screen in the Lebeau, Kobayashi and Danielson combination as further taught by Kobayashi, in order to allow a human operator to immediately and visually review and analyze the results of inspection and thus take immediate action, or make decisions regarding the inspected semiconductor under inspection.

9. Claims 6, 19 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Lebeau (US 5,204,910 – art of record), Kobayashi et al. (US 4,669,123 – art of record) and Danielson et al. (US 4,926,489 A – new art) as applied to claims 1, 15 and 27 above, and further in view of Wagner et al. (US 5,659,172 – art of record).

Regarding each of these claims, Lebeau as part of the Lebeau, Kobayashi and Danielson combination does not disclose picking up the first and second images using an electron beam.

Wagner discloses a system in the same field of endeavor of semiconductor wafer inspection ("detection of defects on semiconductor wafers" at column 1, line 11), comprising picking up images to be inspected using an electron beam (figure 1, numeral 32; see "SEM 22 electron beam 32" at column 4, line 64; "images of an area of the semiconductor wafer which is to be inspected" at column 3, line 2).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize an electron beam scanner as taught by Wagner, as the image pick-up source of the Lebeau, Kobayashi and Danielson combination, in order to detect defects the size of which "falls below the resolution of conventional light optics" (Wagner, column 1, line 43) because of the scanning microscope's ability to resolve "features more that an order of magnitude smaller than the wavelength of visible light" (Wagner, column 1, line 51), thereby improving defect detection sensitivity and thus accuracy.

10. Claims 2 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Lebeau (US 5,204,910 – art of record), Kobayashi et al. (US 4,669,123 – art of record) and Danielson et al. (US 4,926,489 A – new art) as applied to claims 1 and 15 above, and further in view of Haskell et al. (US 6,111,596 – art of record) .

Lebeau discloses an adjustment of the two images "so that their overall brightness is the same" as described at column 5, line 20. While Lebeau describes one embodiment that compares "the mean brightness level of the two images" at column 5,

line 25, Lebeau does not teach a linear conversion of the gain and offset so that the brightness of the images can be made equal. Lebeau states that "[o]ther embodiments use techniques such as ... video amplifier gain ... to match the brightness of the representations of the images" at column 5, line 25. Lebeau is not limited to any one method.

Haskell discloses an image process system in the same field of endeavor of adjusting the two images so that their overall brightness is the same ("mismatch in brightness and/or color balance between the two views of a scene due to differences in imaging parameters is rectified" at column 4, line 15), comprising matching the brightness of two images by means of a linear conversion of gain and offset ("gain and offset differences not only for luminance but also for chrominance are corrected" at column 4, line 13; specifically, see "Method 1" at column 6, line 20; "gain and offset values that must be applied to the right-view image to correct for mismatch can be obtained by solving two simultaneous equations" at column 6, line 34; the equation for gain, "a", is at column 6, line 47 and offset, "b" at line 43; the equations are linear [i.e., not exponential] and thus the correction is linear). The technique of method 1 is best applied to "images having histograms with at least two uniquely identifiable points with ... 'very dark' and 'very bright' contents" as described at column 6, line 21, and this is exactly the situation with Lebeau (see figures 7-9).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Lebeau, Kobayashi and Danielson combination by matching the brightness of the Lebeau images using a linear conversion of gain and offset as

taught by Haskell, in order to more accurately correct for image brightness difference by factoring in both gain and offset, as opposed to just a simple histogram shift as is currently disclosed by Lebeau (see figures 8 and 9 which depict a simple histogram shift), and to provide the additional benefit of correcting a chrominance mismatch (in addition to the luminance, or brightness) thereby providing Lebeau the ability to utilize color images, to more accurately represent the semiconductor under inspection.

11. Claims 31, 33 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Lee et al. (US 5,808,735 A – art of record) and Danielson et al. (US 4,926,489 A – new art) as applied to claims 1, 8 and 22 respectively, and further in view of Teo (US 6,128,108 A – new art).

Lee teaches a local gradation conversion means for performing local gradation conversion to correct a brightness of each of a plurality of pixels in the images (i.e., pixels correspond to the claimed local areas), and thereby match the brightness of one image to that of the other (i.e., "test and reference images differ slightly in intensity" and the "system 20 compensates for these normal intensity differences (step 220) by providing an intensity offset" at column 6, line 15; figure 2A, numeral 220; "normalized for intensity" at column 6, line 42; as described at column 6, lines 30-33, the intensity values of the images are made to correspond more closely with one-another, or corrected with respect to one-another, based on a histogram of differences).

Lee does not teach the local gradation conversion as minimizing a sum of squares of differences between the brightness of the first and second images.

Teo discloses a system in the same field of image processing (i.e., "the present invention relates to digital image processing" at column 1, line 5), and same problem solving area of normalizing two images, or matching the brightness of two images ("variation due to different lighting conditions is reduced" at column 2, line 64; images A and B "which were taken under different lighting conditions" at column 8, line 67; "bring the two images into line with one another. Specifically, brightness, contrast and gamma parameters ... are used to modify image color intensity" at column 9, line 7), comprising a local gradation conversion ("once the brightness, contrast and gamma parameters are determined, they are applied to image A" at column 10, line 27; it can be seen from equation 9 that the parameters are applied to each and every pixel as designated by "x,y" and thus the brightness conversion is local, or takes place in local areas) that minimizes a sum of squares of differences between the brightness of the first and second images ("seeks to match as best possible the color intensities of image A ... using a least sum of squares error criterion ... it seeks to minimize the deviation between the color intensities" at column 9, line 23; see equations 3).

It would have been obvious at the time the invention was made to one of ordinary skill in the art measure and correct the brightness differences between the images of Lee, using the minimization of sum of least squares method taught by Tao, in order to reduce variations "due to different lighting conditions" in which the images were acquired (Tao, column 2, line 64), and thereby "bring the two images into line with one another" and specifically, with respect to "brightness, contrast and gamma parameters" (Tao, column 9, line 7), in a speedy and efficient manner (i.e., Tao, "fast modification of

the image ... avoiding the need to compute equation (2) repeatedly" at column 10, line 65). In summary, the teaching of Tao would allow for all of the image parameters (i.e., brightness, contrast and gamma) to be normalized between the two images of Lee, instead of just the brightness alone as required, thereby providing a more accurate image normalization and thus further helping to reduce the indication of false defects due to mismatched images (Lee, column 6, line 16).

12. Claims 32, 34 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Lebeau (US 5,204,910 – art of record), Kobayashi et al. (US 4,669,123 – art of record) and Danielson et al. (US 4,926,489 A – new art) as applied to claims 7, 15 and 27 above, and further in view of Teo (US 6,128,108 A – new art).

Lebeau teaches local gradation conversion means for performing local gradation conversion to match a brightness of one image to that of the other (i.e., the graylevels of the "[r]un image ... are then mapped based on a comparison of the mean brightness of the taught image to that of the run image" so "the mean brightness level ... is the same as the mean value of taught image" at column 5, lines 50-54).

Lebeau does not teach the local gradation conversion as minimizing a sum of squares of differences between the brightness of the first and second images.

Teo discloses a system in the same field of image processing (i.e., "the present invention relates to digital image processing" at column 1, line 5), and same problem solving area of normalizing two images, or matching the brightness of two images ("variation due to different lighting conditions is reduced" at column 2, line 64; images A

and B "which were taken under different lighting conditions" at column 8, line 67; "bring the two images into line with one another. Specifically, brightness, contrast and gamma parameters ... are used to modify image color intensity" at column 9, line 7), comprising a local gradation conversion ("once the brightness, contrast and gamma parameters are determined, they are applied to image A" at column 10, line 27; it can be seen from equation 9 that the parameters are applied to each and every pixel as designated by "x,y" and thus the brightness conversion is local, or takes place in local areas) that minimizes a sum of squares of differences between the brightness of the first and second images ("seeks to match as best possible the color intensities of image A ... using a least sum of squares error criterion ... it seeks to minimize the deviation between the color intensities" at column 9, line 23; see equations 3).

It would have been obvious at the time the invention was made to one of ordinary skill in the art measure and correct the brightness differences between the images of Lebeau as part of the Lebeau, Kobayashi and Danielson combination, using the minimization of sum of least squares method taught by Tao, in order to reduce variations "due to different lighting conditions" in which the images were acquired (Tao, column 2, line 64), and thereby "bring the two images into line with one another" and specifically, with respect to "brightness, contrast and gamma parameters" (Tao, column 9, line 7), in a speedy and efficient manner (i.e., Tao, "fast modification of the image ... avoiding the need to compute equation (2) repeatedly" at column 10, line 65). In summary, the teaching of Tao would allow for all of the image parameters (i.e., brightness, contrast and gamma) to be normalized between the two images of Lebeau,

instead of just the brightness alone as required, thereby providing a more accurate image normalization and thus further helping to match the two images for subsequent comparison (Lebeau, "match the desired run image greylevels" at column 8, line 56).

Conclusion

13. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian P. Werner whose telephone number is 703-306-3037. The examiner can normally be reached on M-F, 8:00 - 4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo H. Boudreau can be reached on 703-305-4706. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9314 for regular communications and 703-872-9314 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-4750.

Brian Werner
Patent Examiner
May 8, 2002

BRIAN WERNER
PATENT EXAMINER
ART UNIT 2621